Available online at www.sciencedirect.com

ScienceDirect

Procedia Engineering 129 (2015) 886 – 890

Procedia Engineering

www.elsevier.com/locate/procedia

International Conference on Industrial Engineering

The usage of 156 mm diameter continuous cast billets on “140” pipe-rolling plant for pipe production

Sherkunov V., Korsakov A.*

South Ural State University, 76, Lenin Avenue, Chelyabinsk, 454080, Russian Federation

Abstract

The research on the possibility of unification of piercing and reeling mills rolls for screw rolling for both decreasing and increasing the diameter of crude pipes was conducted. In the result the possibility was confirmed. The technology of wide range of sizes “140” pipe-rolling plant 156 mm diameter continuous casting pipe production was developed to use one roll design on piercing mill and one roll design on reeling mill instead of two roll designs for each therefore decreasing the amount of sizing mills grooves.

Peer-review under responsibility of the organizing committee of the International Conference on Industrial Engineering (ICIE-2015)

Keywords: continuous cast billet, piercing, reeling, rolls, point, diameter decreasing, diameter increasing, unification of mills.

1. Introduction

Due to the change of usage continuous cast billets for seamless pipe production the problem of 89-121mm diameter on “140” pipe-rolling plant pipe production from 156 mm diameter continuous casting occurred.

The main problem is that existing 120 mm and less diameter pipe production technologies use under 150 mm and less diameter continuous cast and rolled billet.

2. Some time ago

In order to solve this problem a new prospective technology was developed. This technology allows gradual

* Corresponding author.
E-mail address: bkorsakov174@gmail.com

Peer-review under responsibility of the organizing committee of the International Conference on Industrial Engineering (ICIE-2015)
doi:10.1016/j.proeng.2015.12.120

decrease of the billet diameter on every hot rolling operation of “140” pipe-rolling plant (protected by Russian Federation patents) [1, 2] and manufacture of 89-121 mm diameter pipes from 156 mm diameter continuous cast billet. The new technology was successfully tested on “140” pipe-rolling plant pipe production at “Sinarskiy pipe plant” [3].

Despite the advantages of the new technology its implementation was put on hold due to emerging of a new problem. “140” pipe-rolling plant is designed not only for 89-121 mm diameter pipe production, but also for under 168 mm diameter. At the same time the usage of two and more different roll design on screw rolling mill (piercing and reeling) is not efficient because of long period of time to change one type of rolls to another (up to 8 hours).

In order to extend the possibilities of the new technology in the field of pipe range of sizes diversification it was carried out a research of “140” pipe-rolling plant hot rolling technological line processing equipment.

3. Piercing operation

According to a new technology on a piercing mill was introduced to use suitable element design roll for increased deformation of the billet that guarantee a crimp of workpieces and a production of rough tubes with a diameter decreasing and an internal tool of a special structure that increase its durability.

A new design analysis of “140” pipe-rolling plant continuous cat billet straining geometric and velocity features showed a reserve availability for producing hollow shells for both decreasing and increasing the diameter (provided the usage of additional shoes and points and a billet deformation design correction). Fig. 1.

In case of hollow shell decreasing diameter piercing (Fig. 1-a) a roll grip allows a billet to make 1-1.5 half-turn during a feed pitch before impact with severe deformation collar. End point is between gorge and a severe deformation collar.

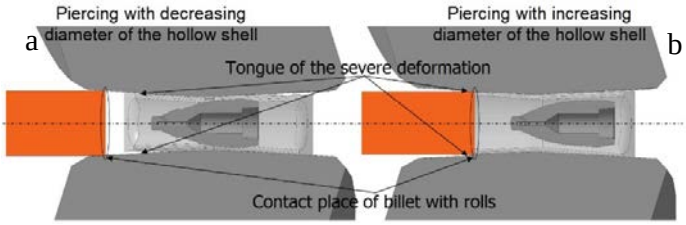


Fig. 1. Various new roll piercing mill schemes with a severe deformation collar.

In case of hollow shell increasing diameter piercing (Fig. 1-b) a roll distance grows and a roll billet grip is after severe deformation collars. End point is pulled outside the gorge so that before impact a billet make 1-1.5 half-turn during a feed pitch.

4. Reeling operations

A geometric and velocity features new technology analysis with a crude pipe diameter decreasing also shows a reserve availability that allow the usage the same reeling mill roll design both decreasing and increasing an outside diameter (provided the usage of different special design point groups for every scheme of deformation). Fig. 2.

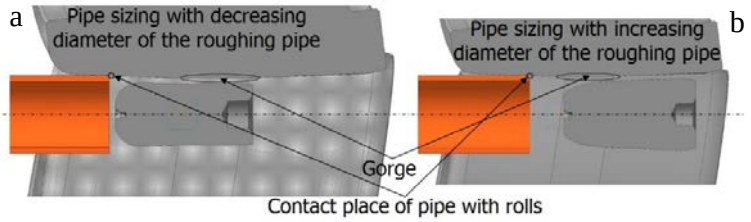


Fig. 2. Characteristic of two different crude pipe reeling schemes.

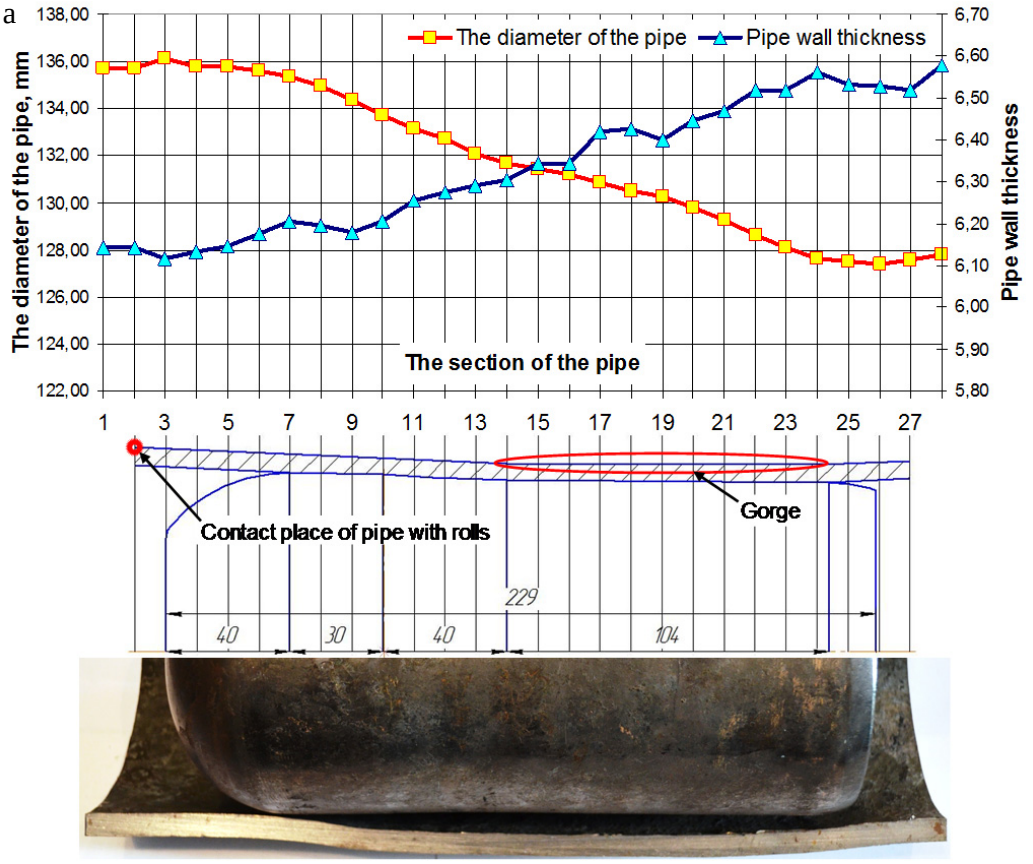
The main characteristic of two different crude pipe reeling schemes (Fig. 2) is the usage of different point types: 1 – inverted cone point (Fig. 2-a) is for a crude pipe diameter decreasing. The point position is in deformation zone in the inlet cone and roll pitch point area; 2 – right cone point (Fig. 2-b) is for a crude pipe diameter increasing. The point position is in pitch point and in the outlet cone. A point of a crude pipe engagement with both rolls has no big differences.

5. Experimental research

"Sinarskiy pipe plant" made an experimental run research both decreasing and increasing an outside crude pipe diameter at the same roll groups. A 136-6mm diameter crude pipe was put into reeling mill deformation zone and rolled in different norms. (Fig. 3).

As it is showed on the Fig. 3, depending on the point type both decrease and increase of the crude pipe diameter can be reached with the same type of roll: the maximum diameter decrease is 89 mm (with the thickening of pipe wall up to 0.05 mm – Fig. 3a).

The maximum diameter increase is up to 14 mm (with the thinning of pipe wall up to 0.4 mm Fig. 3b). This figures can be used for development of point-to-point technology of wide size range of 156mm diameter seamless pipe production on "140" pipe-rolling plant.



b

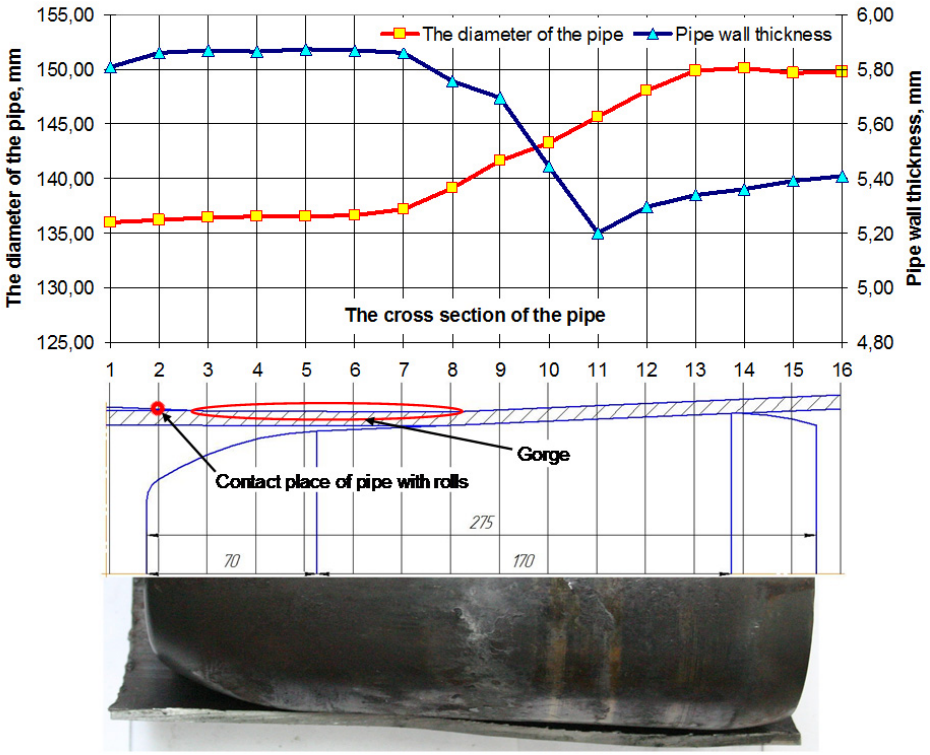


Fig. 3. Experimental research of two different crude pipe reeling schemes.

6. New technology

Taking into account the results of experimental and theoretical studies, border-line conditions and kinematic characteristics of the rolling process a new technology of wide size range of 156mm diameter seamless pipe production on “140” pipe-rolling plant was developed (Fig. 4) to improve the quality of pipe inner surface using piercing mill point with increased diameter spout and to improve the precision of pipe thickness using reeling mill point with combination of back taper and parallel section.

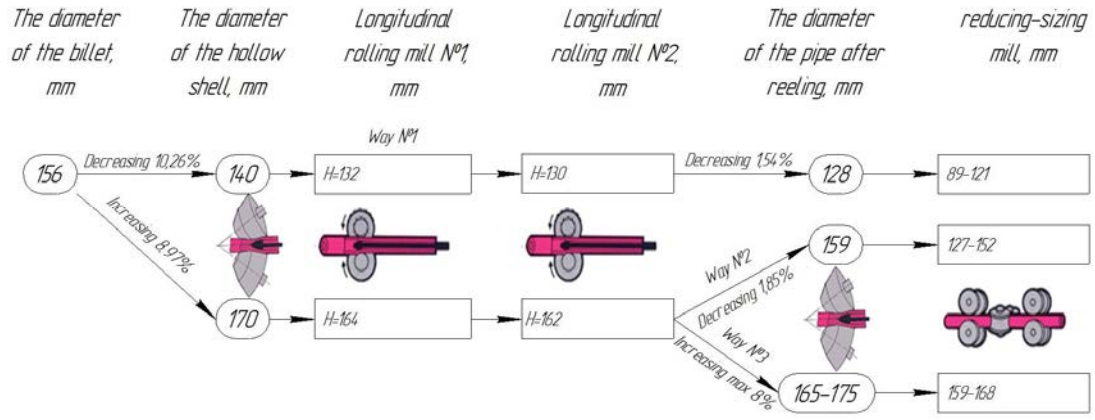


Fig. 4. New technology of “140” pipe-rolling plant 156mm diameter seamless pipe production wide size range.

Summary

The main advantages of the developed technology are a billet standard size amount reduction from 4 to one, a piecing mill roll design reduction from 2 to 1, a reeling mill roll design reduction from 2 to 1, a longitudinal rolling mill groove reduction from 3 to 2.

References

[1] Pysmintsev I.J., Kurjatnikov A.V., Korol A.V., Korsakov A.A. and others *Sposob vintovoy proshivki litoy zagotovki* [Merhod of helical piercing of cast billet]. Patent RF, no. 2489220, 2013.
[2] Pysmintsev I.J., Kurjatnikov A.V., Korol A.V., Korsakov A.A. and others *Sposob proizvodstva goryachekatanykh trub* [Methods of hot-rolled pipe production]. Patent RF, no. 2489221, 2013.
[3] Kurjatnikov A.V., Korol A.V., Korsakov A.A. Research of pipe sizing process on three-roll screw rolling mill TPA “140” AT JSC “Sinarsky pipe plant”. Bulletin of the South Ural Stare University Serial “Metallurgy”, 2013, vol. 13. No. 1, pp. 160-164 (in Russia).